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THE FACTORS OF HEREDITY AND ENVIRONMENT IN MAN¹

DANIEL G. BRINTON, M. D.

When we look over the works of living anthropologists we find they differ remarkably in their teachings concerning the relative influence of heredity or inherited traits and those external agents which we call the environment or surroundings, and to which the French apply the term *le milieu*.

As an example of one school, I may take Dr Lombroso, who, in the *Revue Scientifique* for April of this year, 1898, sums up a discussion of the question with the magisterial conclusion, "The influence of the *milieu* is strong enough to annihilate all ethnic traits." In this respect he agrees with most of the Russian, English, and American anthropologists. They give little weight to purely ethnic factors, and assign a far greater influence to climate, food, and to social, industrial, and religious conditions.

In this they materially differ from most French and many German writers; for instance, Collignon, Vacher de Lapouge, Topinard, Jacoby, and Otto Ammon. Their opinion may be summed up in the words of the first mentioned: "Along with the difference in race, which is a purely anatomical fact, seen in the shape of the head, the color of the eyes, etc, there is associated a difference of brain, which is revealed by a special direction of the thoughts and the display of particular mental powers." These are transmitted from parent to child and largely decide on the position a given stock will occupy in the social struggle for life and fortune.

For example, Ammon and Lapouge have argued from an immense mass of evidence that the stress and strain of modern city life can be borne successfully only by those who inherit a dolichocephalic skull and a fair complexion!

The contrast of the two opinions may be exemplified, on the one hand, by our late eminent colleague, Mr Horatio Hale, who argued once in my hearing that a colony of Germans located in

¹ Opening of a discussion before the Section of Anthropology at the meeting of the American Association for the Advancement of Science, Boston, August, 1898.

Australia under the same conditions as the black tribes there, would in three generations become as degraded as they, and much like them in appearance; and, on the other, by the exclamation of the philosopher Hegel when some one was explaining the high artistic sense of the Greeks by the beauty of their natural surroundings: "Talk to me not of the inspiration of Ionian skies. Have they not for nigh two thousand years rested over a degraded and enslaved race?"

The one believed the environment is all-powerful over man, the other that man owes to it no part of the real dignity and beauty of his soul-life.

A highly scientific school of German writers have aimed to define the influences of geographical relations on man with precision. They begin with the accepted fact that the earth can be mapped into zoölogical areas, each with its peculiar fauna. This is the basis on which Professor Bastian builds his doctrine of "geographical provinces," which are to be understood not as limiting migration, but rather as culture-areas. Their influence, consequently, is to be looked for in nations, rather than in races or consanguine groups.

Following this theory to its limit, von Ihering wrote his remarkable study, "The Evolution of the Aryan," an English translation of which was published last year. His oft-repeated maxim is, "The soil is the nation." But the question of their relation is more justly answered in Professor Ratzel's prize essay, "The State and the Soil," than in Ihering's brilliant monograph.

To reach correct conclusions on this difficult question we must first define clearly what is to be understood by the *milieu* or environment, and next how we understand the origin and transmission of "hereditary" traits, so called.

As taught by Professor Capitan in the Paris school of Anthropology, everything is *milieu*, and there is no place for heredity. He divides the environment into the "exterior" and the "interior." The former embraces the physical, geographical, and social surroundings, while the latter includes nutrition, heredity, pathology, immunity, and so forth. Of course, in this scheme there is no contrast of factors. The individual or *ego* is regarded as a psychic entity, to whom his body, with all its peculiarities, is a portion of his surroundings.

However true this may be, it does not do away with the traits

which make up family, stock, and race, and it is to such, as in opposition to those which arise from temporary and variable externalities, to which we should direct our attention.

No one can question but that the broad physical traits which distinguish the subspecies of men are faithfully transmitted and have been for many thousand years. They are indelible by change of position on the earth's surface, so long as the strain is kept pure. Certain mental traits and faculties are broadly correlated to these physical features, and no amount of sentimentality about the equality of all men can do away with this undeniable truth. Here we have solid ground for maintaining the potency of hereditary factors.

But the subspecies are and have been constantly intermingling, and so to a still greater degree have been the narrower stocks. Dr Collignon asserts that there is not a man "of pure race" in Europe. What becomes of the racial traits in such case?

The answer has not yet been fully worked out; but we may say with certainty this much: that the psychical are transmitted along with the physical peculiarities; that in hybrids each peculiarity of either of the parents may be transmitted independently of the others; that there is no known explanation why sometimes the male, at others the female, impresses the offspring to a greater degree; that not only do certain traits of either parent appear only late in the life of the offspring (deferred or "homochronous" heredity), but may skip a generation before their appearance.

These are facts of observation, whether we are able to explain them or not. To them are to be added some more general principles, as that frequent marriages between specialized types tend to obliterate their peculiarities and bring them to a general type, and that the trait or traits which are most distinctive of a stock are those which are subject to the greatest relative variation within the stock. This last curious law was well developed last year in reference to stature by Mr E. T. Brewster (in *Proceedings of the American Academy of Arts and Sciences*).

As for "reversion," by which we mean the tendency to go back to the typical form of a very remote ancestor, and "atavism," which conveys nearly the same notion, it may be said that the most recent studies of the subject have much invalidated their standing in scientific circles. The latest explanation of this sup-

posed mysterious attraction of an ancestral type is simply that variations are constantly going on in the human organism in all directions, impelled by present forces, and when they happen to simulate what we *suppose* was the ancestral type we claim it as "reversion," whereas in fact it is purely fortuitous. Much force is added to this position that such imagined "reversions" are nearly always in single characteristics, and not in the type as a whole. This is notably true of the supposed "pithecoïd" forms of human bones, as has been shown by Professor Thomas Dwight and myself, and has been recognized as true generally in vertebrate anatomy by Professor H. F. Osborn.

What is it that has the power of carrying down from generation to generation the ethnic traits? Darwin proposed to explain this by the hypothesis of "pangenesis," which was that every cell throws off undeveloped gemmules, which are transmitted to the offspring and may remain undeveloped for years or for generations. This of late has been supplanted by the doctrine of Weissmann that the germinal substance, the chromatin, is the bearer of the hereditary diathesis, although in itself it does not undergo assimilation. Hence Lapouge calls it "immortal." It is safe to say that there is no substantial evidence for either of these hypotheses.

How did the ethnic hereditary traits come into being? A score of years ago the unanimous answer would have been, "By use and disuse, by selection and survival of the best adapted."

But the doctrines of Weissmann dealt a severe blow to this facile reply. He attacked with such success the theory that acquired characters could be transmitted that even so judicious a writer as Otto Ammon lays it down as a fundamental principle of human heredity, that "congenital traits may be transmitted, but not those which are acquired," and so have many others.

A reaction, however, is noticeable in the application of the rigor of this theory. It has been ably voiced by Professor Virchow in a paper read before the Prussian Academy of Sciences two years ago on "Diathesis and Variation." He divides variations in man into primary (acquired) and secondary (inherited) and aims to establish the following theses:

"1. No secondary (inherited) variation can take place unless preceded by a primary (acquired) variation.

"2. No primary variation can take place without an external cause.

"3. Secondary variations do not arise from or depend upon external causes, although they may be influenced by them."

To defend these positions he has large recourse to a field on which he stands easily master—that of pathology. In that the most ardent Weissmannist must acknowledge that acquired characters are surely and in certain cases uniformly transmitted to succeeding generations.

But the advocate of cellular pathology, that system of which Virchow has been the life-long and successful exponent, will not admit that the great principles of cell-life found true in it are false elsewhere. Therefore, what is proved for the diseased cell should hold good for that which is in its normal state, and the above theses stand firm against attack.

Some, however, may say that the processes of health and disease are not alike, but in contrast, and that what is true for the infected is not so for the normal cell or structure.

To this the reply is easy. Where is the individual who is *not* diseased? Where the tissue which has no sign or tendency to decay about it? Nowhere. I quote again Professor Capitan in a lecture before the Anthropological School of Paris: "Everybody is diseased. Nobody is healthy. We anthropologists are obliged to deal with mankind as in a constantly morbid condition of body and mind."

The peculiar traits of races can with entire propriety be considered pathological; for the more completely they adapt a group to one environment, the more do they unfit it for any other.

In fine, we must accept ethnic characteristics as originally acquired traits, slowly strengthened by repetition and natural selection in some more plastic stage of the life of the species than the present, and hence impressed indelibly upon its members.

How does this apply to the inherited traits of the smaller human groups, the "family likeness," the local stamp, and the *sangre azul*?

Here is a wide field, which has been worked with profit by Galton in England, by Benoiston de Chateauneuf in France, by Dr Reibmayr in Germany, and others, but about which we are far from having sufficient material with which to erect positive statements of laws. Enough, however, has been collected to give in a general way scientific support to the popular belief that "blood will tell." Moreover, if we have a right to draw analo-

gies from the lower animals, the advantages of belonging to a truly noble house are incontestable. Lamartine was not altogether wrong when he wrote, "*La source de génie est dans la race.*"

But the question cannot be closed here. There are some all-important considerations that the anthropologist must bear constantly in mind in this discussion. It will not do for him to proceed as if the destiny of man is controlled by these factors merely. Others come into play of the first order of importance.

First, he should remember that the dependence of man on his environment is not a fixed quantity. On the contrary, it is eminently fluctuating, steadily diminishing in proportion to his progress in what we call culture or civilization. In the most-favored spots today it is reduced almost to a zero, so far as its bearings on man's higher, soul-life is concerned. The progress of man is his progress of gaining independence from nature, of making her forces his slaves and not leaving them his masters.

Then there are two psychical elements which are largely independent both of heredity and environment—the one is Temperament, the other Character.

Professor Manouvrier has lately thought it of sufficient pertinence to publish several carefully studied lectures on Temperament, and he is certainly wise in vindicating for it an extreme importance. He defines it as "the determining cause of the intellectual and moral traits of the individual." Upon it depends the quantity of potential energy in the organism and the extent of its resistance to agencies injurious both to the physical and psychical faculties. Hence it is the measure of the liability to degeneration and the criterion of the capacity for advancement in all that counts for the higher life of the species. It is wholly independent of geographic environment, often strangely in contrast with it, and although it is frequently ethnic, it is doubtful whether that is due to transmission, but rather to individual tendency.

The Character is that which is essentially the personal element in humanity. It is neither inherited nor acquired. In his remarkable analysis of it Professor Wundt has clearly shown that in it lies the efficient cause of the Will, and though its genesis eludes our research, it probably begins with the very inception of the individual life. In its essential traits it ever bides the

same, resisting all external agencies.¹ This it is which, in the last analysis, prompts the decisions, guides the actions, and carves the destiny of men and nations.

THE DWARF TRIBE OF THE UPPER AMAZON

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In the June number of *L'Anthropologie* the editor of that excellent journal publishes what he believes is the confirmation of the story of a tribe of dwarfs on the tributaries of the upper Amazon. His authority is vague—"an American traveler, Mr Sullivan," who says: "I found on the Rio Negro beings (*des êtres*) of a remarkably small stature. . . . So far as I could learn, they live near the sources of the Orinoco, or in that part of Venezuela which adjoins the frontiers of Brazil. They are only four feet eight inches in height and the women still less."

The editor of the journal recalls that Humboldt refers to the alleged existence of these dwarfs about this locality,² and regards Mr Cunningham's statements as a confirmation of the assertion.

It is timely, therefore, to review what has been said of this supposed pygmy race while we wait for more positive recent observations.

The story long antedates Humboldt, for it goes back to the publication of Father Acuña's voyage on the Amazon, the account of which was printed in Madrid in 1641. He heard of them from the Tupinambas, who called them *Guayazis*, evidently *guara*, men, with the diminutive suffix *çiey* = "little men."

I am inclined to believe that the father here fell into an error, taking the term literally, when, in fact, it was intended merely as an epithet of depreciation and contempt, for Father Coleti in the next century described these *Guayazis* as living on the south bank of the Amazon and not as small in stature, but in

¹ *Menschen-und Thierseele*, Sect. 29.

² Near Esmeraldas, on the Orinoco, Humboldt measured a family whose adults averaged in height five feet, three inches, English measure (*Personal Narrative*, vol. II, p. 463). They belonged to a tribe called *Guaicas*, but he could not learn whether the other members of the tribe were similarly undersized. They are possibly the same as the *Guaicanes* mentioned by Uricoechea as dwelling at present on the Rio Meta (*Gramatica de la Lengua Chibcha*, Introd. p. xxxviii).